

REVISION OF *BREGMACEROS* WITH DESCRIPTIONS OF LARVAL STAGES FROM AUSTRALASIA

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(WITH TEN FIGURES IN THE TEXT).

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SUMMARY.

Six species of the genus *Bregmaceros* are recognised, including *B. varisquamosus* sp. nov. from New Guinea and the Solomon Islands. All are described, references to species listed, and the distribution of the genus is given. On the basis of larval and post-larval stages, *B. macclellandi* is recorded from eastern Australia and *B. japonicus* and *B. nectabanus* are recorded from eastern Australia and New Guinea. The larval and post-larval stages are described and figured.

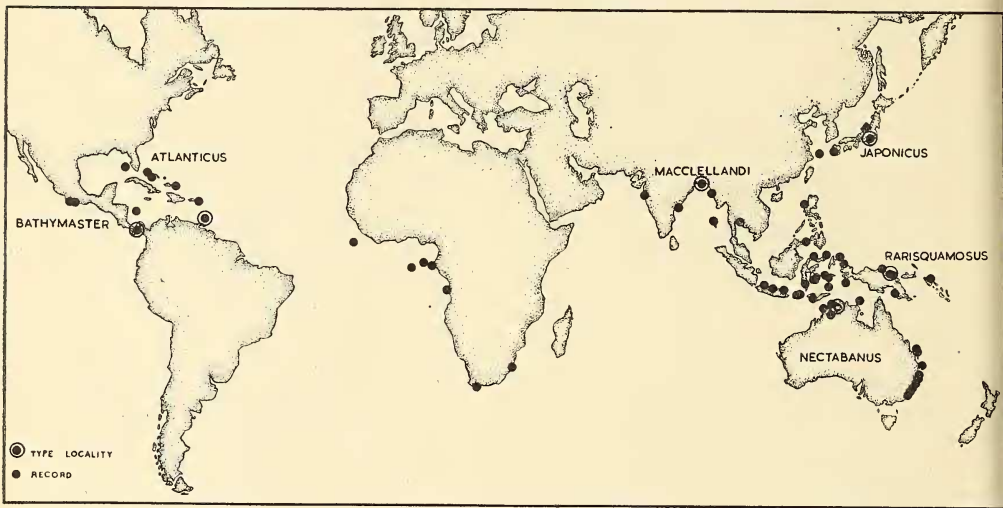
INTRODUCTION.

A large series of plankton collections obtained off the eastern coast of Australia during the period 1938 to 1942 by F.R.V. "Warreen," fisheries research vessel of the Commonwealth Scientific and Industrial Research Organization, has yielded seventy-two larval fishes of the genus *Bregmaceros*. F.R.V. "Stanley Fowler," another survey vessel of this organization, obtained by means of a submarine lamp six specimens from Northern Territory and North-Western Australia in 1949. During 1948 to 1950, M.V. "Fairwind," fisheries survey vessel of the Department of External Territories, obtained by means of a submarine lamp fourteen additional specimens in Papua, New Guinea, and the Solomon Islands.

The identification of Australasian material has necessitated a review of the literature dealing with all described forms. Type material has not been accessible, but the differences between species have been obtained from published descriptions and figures. Compilations of adult characters and complete lists of references have been drawn up for each of the six species recognised. A revised key has been prepared to distinguish at least the adults of the accepted species. The distribution of the genus has been summarised by means of a map (Text Fig. 1).

The genus *Bregmaceros* was proposed by Thompson (1840, p. 184) for *B. macclellandi* from the Ganges River. Günther (1889, p. 24) rightly placed *Calloptilum mirum* Richardson (1843, p. 46) from China Seas and *Asthenurus atripinnis* Tickell (1865, p. 32) from Burma (Akyab) in the synonymy of *B. macclellandi*. Five other forms have since been described, some of which have been considered worthy only of sub-specific or varietal rank. These are *B. atlanticus* Goode and Bean (1886, p. 165) from the West Indies, *B. bathymaster* Jordan and Bollman (1889, p. 173) from the Gulf of Panama, *B. longipes* Garman (1899, p. 191) from western Mexico, *B. japonicus* Tanaka (1908, p. 42) from Japan, and *B. nectabanus* Whitley (1941, p. 25) from Darwin, northern Australia.

The status of the various forms is poorly understood. Parr (1931, p. 48) recognised the need for a revision and presented a key to distinguish four species. On the other hand, Norman (1930, p. 339) followed the simpler course. By ignoring differences, he united all Atlantic, Pacific and Indian Ocean material in a single species. This view is not accepted as larval material from eastern Australia is composed of three species, and three species occur in adjacent localities in New Guinea. This immature material serves to show that authors have been in error in assuming that variations in pigmentation are due to different stages in development of the one species.



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TEXT FIG. 1: Distribution of the genus *Bregmaceros* Thompson.

KEY TO SPECIES.

- I. Less than 70 scales in longitudinal series :
 - 1. Ventral fins half body length without caudal ; less than 50 scales in longitudinal series ; body and fins pale and hyaline *B. varisquamosus*
 - 2. Ventral fins two-thirds body length without caudal ; more than 50 scales in longitudinal series ; body and fins in part dusky or with numerous black dots :
 - A. 10 scales in transverse series :
 - a. Eye 3.0 in head, nearly twice snout ; interorbital less than eye ; body silvery with rows of black dots near bases of dorsal and anal fins *B. bathymaster*
 - aa. Eye 3.5 to 4.0 in head, equal to or shorter than snout ; interorbital conspicuously wider than eye ; body uniformly dark ... *B. atlanticus*
 - AA. 14 to 16 scales in transverse series ; body silvery, minutely dotted with brown ; at least dorsal fins black *B. macclellandi*
- II. More than 70 scales in longitudinal series :
 - 1. 13 or 14 scales in transverse series ; eye less than interorbital and snout ; depth more than 8 in length without caudal, less than height of anal rays ; body dusky ; fins dark *B. japonicus*
 - 2. 17 scales in transverse series ; eye greater than interorbital and snout ; depth less than 7 in length without caudal, nearly equal to height of anal rays ; body pale with brown dorso-lateral stripe ; fins pale *B. nectabanus*

BREGMACEROS RARISQUAMOSUS sp. nov.

(Fig. 10)

D. (11-14) + (7-12) + (14-18), (36-39). A. (12-15) + (7-12) + (15-18), (38-40). P. 15-16. C. 24-26. Lat. sc. 43-50. Trans. sc. 10-12. Depth 5.0 to 6.1, head 5.1 to 5.6 in body length without caudal. Eye very large, 2.7 to 3.5 in head, 0.25 to 0.5 greater than snout, 1.3 to 1.7 in interorbital. Maxilla extends to below the posterior third of the eye, 1.9 to 2.1 in head. Nuchal appendage equal to, or 0.2 greater than head. Dorsal fin inserted slightly in advance of the anal fin. Longest anal ray 0.9 to 1.1 in head. Ventrals 0.45 to 0.5 of body length without caudal, extending to half way along the anterior raised portion of the anal fin. Pectorals 1.4 to 1.6 in head. (See Table I).

Eye black. Flesh glassy transparent in life, white when preserved. Body ornamented with large stellate melanophores. An hour-glass-shaped patch present on the postero-dorsal aspect of the head between the eyes and the nuchal appendage consisting of five small clusters, the three anterior composed of large melanophores and the two posterior of small spidery melanophores. On the dorso-lateral aspect of each side of the body is a weak, sub-horizontal stripe, extending from the upper angle of the operculum to the caudal peduncle, composed of two or more series of melanophores. The cells are largest under the posterior elevated part of the dorsal fin, and smallest under the low middle section of the dorsal fin. The vertebral column is heavily pigmented with large internal melanophores. A single series extends along the ventral mid-line of the trunk between the origins of the ventral and anal fins. Fins hyaline. Rays of posterior part of dorsal fin lightly dotted with minute melanophores.

This species is closest to *B. nectabanus* Whitley. Both species are similar in coloration, but fin and scale counts differ considerably. The New Guinea species has fewer dorsal and anal rays, and considerably less horizontal and vertical tracts of scales. It has a larger eye and shorter ventral fins.

Based on two sexually mature females (28.5, 33.3 millimetres) from Bostrem Bay (Sek Harbour), north coast of New Guinea (27.12.48) and three young adults (23.0, 24.5, 25.5 millimetres) from Port Moresby Harbour, Papua (2.7.48). Post-larval stages were obtained at Madang Harbour, north coast of New Guinea and Kieta Harbour, eastern Bougainville, Solomon Islands. All were attracted to the surface at night using a submarine lamp. The material was collected on the M.V. "Fairwind." The largest adult female from Bostrem Bay is selected as holotype and deposited at the Marine Biological Laboratory, Division of Fisheries, Commonwealth Scientific and Industrial Research Organization.

Larval Stages :—Five post-larval stages are referred to this species.

Length	Locality	Date	Dorsal Fin Rays	Anal Fin Rays
16.4 mm.	Kieta, Bougainville ...	21.10.49	13+12+14, (39)	14+ 8+17, (39)
17.0 mm.	Kieta, Bougainville ...	22.10.49	14+ 9+15, (38)	15+ 9+15, (39)
18.2 mm.	Kieta, Bougainville ...	21.10.49	14+12+14, (38)	12+ 8+18, (38)
19.7 mm.	Kieta, Bougainville ...	22.10.49	13+ 7+18, (38)	14+10+15, (39)
21.5 mm.	Madang, New Guinea ...	26.11.49	13+11+15, (39)	12+10+18, (40)

TABLE I.—FIN RAY COUNTS, SCALE COUNTS AND BODY PROPORTIONS OF FIVE ADULT INDIVIDUALS OF *Bregmaceros varisquamatus*.

	A	B	C	D	E
Locality ...	Port Moresby	Port Moresby	Port Moresby	Bostrem Bay	Bostrem Bay
Total Length ...	25.5 mm.	23.0 mm.	24.5 mm.	33.3 mm.	28.5 mm.
Dorsal Fin ...	11 + 9 + 16, (36)	12 + 9 + 15, (36)	11 + 10 + 15, (36)	12 + 12 + 14, (38)	14 + 8 + 17, (39)
Anal Fin ...	13 + 11 + 16, (40)	13 + 10 + 15, (38)	13 + 10 + 15, (38)	12 + 12 + 15, (39)	14 + 7 + 17, (38)
Lateral Scales ...	50	48	46	44	43
Transverse Scales ...	11	12	11	10	10
Body/Head ...	5.4	5.6	5.2	5.1	5.5
Body/Depth ...	6.1	6.0	6.1	5.0	5.7
Head/Eye ...	3.3	3.5	3.3	2.7	2.9
Eye/Snout ...	1.5	1.25	1.5	1.5	1.5
Interorbital/Eye ...	1.7	1.3	1.4	1.3	1.3
Head/Pectoral Fin ...	1.5	1.5	1.5	1.4	1.6
Head/Maxilla ...	2.0	2.0	2.0	1.9	2.1
Nuchal Appendage/Head ...	1.0	1.1	1.0	1.2	1.1
Head/Anal Fin Rays ...	1.1	0.9	1.1	1.0	1.0
Body/Ventral Fin Rays ...	2.3	2.1	2.3	2.2	2.3

16.4 to 21.5 millimetre post-larvae.—Most of the adult facies present. Depth 6.0 to 7.0, head 4.5 to 5.5 in body length without caudal. Eye relatively smaller than in adults, 4.0 to 4.5 in head, equal or 0.2 greater than snout, 0.2 less than to 0.2 greater than interorbital. Maxilla extends to below posterior border of pupil. Nuchal appendage equal to or 0.2 less than head, not reaching origin of dorsal fin. Dorsal fin inserted above or slightly in advance of anal fin. Ventrals 0.4 to 0.45 of body length without caudal. Pectorals 0.5 to 0.7 of head length. Scales present but difficult to count; one example from Madang has 11 transverse and 49 lateral series. Flesh white in preserved condition, transparent in life. Pigmentation similar to adults but melanophores are smaller and less numerous. The dorso-lateral stripe is composed of a single series of small melanophores restricted to the caudal region. Pigmentation is insufficient to distinguish these post-larvae from those of *B. nectabanus* of similar size and development.

BREGMACEROS NECTABANUS Whitley.

Bregmaceros nectabanus Whitley 1941, p. 25, fig. 18 (Darwin, Northern Territory, Australia—Type locality).

Bregmaceros maccllelandi (non Thompson) Kent 1889, p. 240 (Cambridge Gulf, NW. Australia). McCulloch 1926, p. 29 (Darwin). Paradise and Whitley 1927, pp. 81, 97 (Darwin).

D. (12-18) + (9-16) + (17-23), (40-55). A. (15-19) + (9-12) + (17-24), (42-53). C. 28. Lat. sc. 70-74. Trans. sc. 17-18. Depth 6.1 to 6.6, head 5.2 to 5.9 in body length without caudal. Eye small to moderate, 3.4 to 3.8 in head, equal or 0.1 greater than snout and equal or 0.2 greater than interorbital. Maxilla reaches to below posterior border of eye, 1.6 to 2.0 (1.8) in head. Nuchal appendage 0.1 to 0.4 longer than head. Dorsal fin inserted slightly in advance of the anal fin. Longest anal rays 0.8 to 0.9 of head length. Ventrals 0.5 to 0.6 of body length without caudal, extending to end of anterior raised portion of anal fin. Pectorals 1.4 to 1.7 in head. (See Table II).

Eye black. Flesh yellowish-white in spirits, probably transparent in life. Body ornamented with large, indistinct stellate melanophores. A group is present on the postero-dorsal aspect of the head. An indistinct brownish stripe composed of one or two series of melanophores extends along each side from the upper angle of the operculum to the caudal peduncle. The fins are hyaline. The pigmentation is similar to that of *B. rarisquamosus* but the melanophores are smaller and more numerous.

Based on the holotype (Australian Museum Reg. No. IA 1719) collected at Darwin in 1923 by Dr. W. E. J. Paradise during survey work by H.M.A.S. "Geranium." Additional adult material was obtained by F.R.V. "Stanley Fowler" in Northern Territory and North-Western Australia. This consists of four specimens from Marchinbar Island, Wessel Group (18.10.49), one from Timor Sea, 30 miles WNW. of Charles Point, Northern Territory (22.9.49) and one from Mission Bay, Napier Broome Bay, Western Australia (11.12.49). All were attracted to the surface at night by a submarine lamp. Occurrence of this species on the north coast of New Guinea is based on three post-larval stages from Wewak Harbour collected on 23.11.49 from M.V. "Fairwind" with the aid of a submarine lamp. The distribution is also extended to the coasts of Queensland and New South Wales, based on sixty-four

TABLE II.—FIN RAY COUNTS, SCALE COUNTS AND BODY PROPORTIONS OF SEVEN INDIVIDUALS OF *Bregmaceros neclabanus*.

	Holotype	A	B	C	D	E	F
Locality	Darwin	Wessel Is.	Wessel Is.	Wessel Is.	Wessel Is.	Timor Sea	Napier Broome Bay
Total Length	32.0 mm.	54.0 mm.	49.8 mm.	39.5 mm.	30.5 mm.	30.0 mm.	34.0 mm.
Dorsal Fin	14+16+20, (50)	17+15+23, (55)	17+12+22, (51)	15+15+21, (51)	16+12+17, (45)	12+10+18, (40)	15+16+22, (53)
Anal Fin	19+11+23, (53)	16+12+22, (50)	18+11+24, (53)	17+11+22, (50)	15+10+17, (42)	16+10+17, (43)	17+11+24, (52)
Lateral Scales	73	74	74	73	70	70	71
Transverse Scales	17	18	16	17	17	17	18
Body/Head	5.8	5.9	5.5	5.5	5.5	5.2	5.4
Body/Depth	6.5	6.6	6.5	6.5	6.2	6.1	6.6
Head/Eye	3.7	3.6	3.7	3.8	3.8	3.6	3.4
Eye/Snout	1.0	1.0	1.1	1.0	1.0	1.0	1.1
Eye/Interorbital	1.2	1.0	1.0	1.0	1.0	1.0	1.0
Head/Pectoral Fin	1.7	1.5	1.5	1.5	1.4	1.4	1.5
Head/Maxilla	1.8	1.6	1.8	1.8	1.8	2.0	1.8
Nuchal Appendage/Head	1.1	1.2	1.3	1.4	1.2	1.3	1.3
Head/Anal Fin	1.2	1.2	1.2	1.1	1.1	1.2	1.1
Body/Ventral Fin Rays	1.6	1.7	1.8	2.0	2.2	2.0	1.8

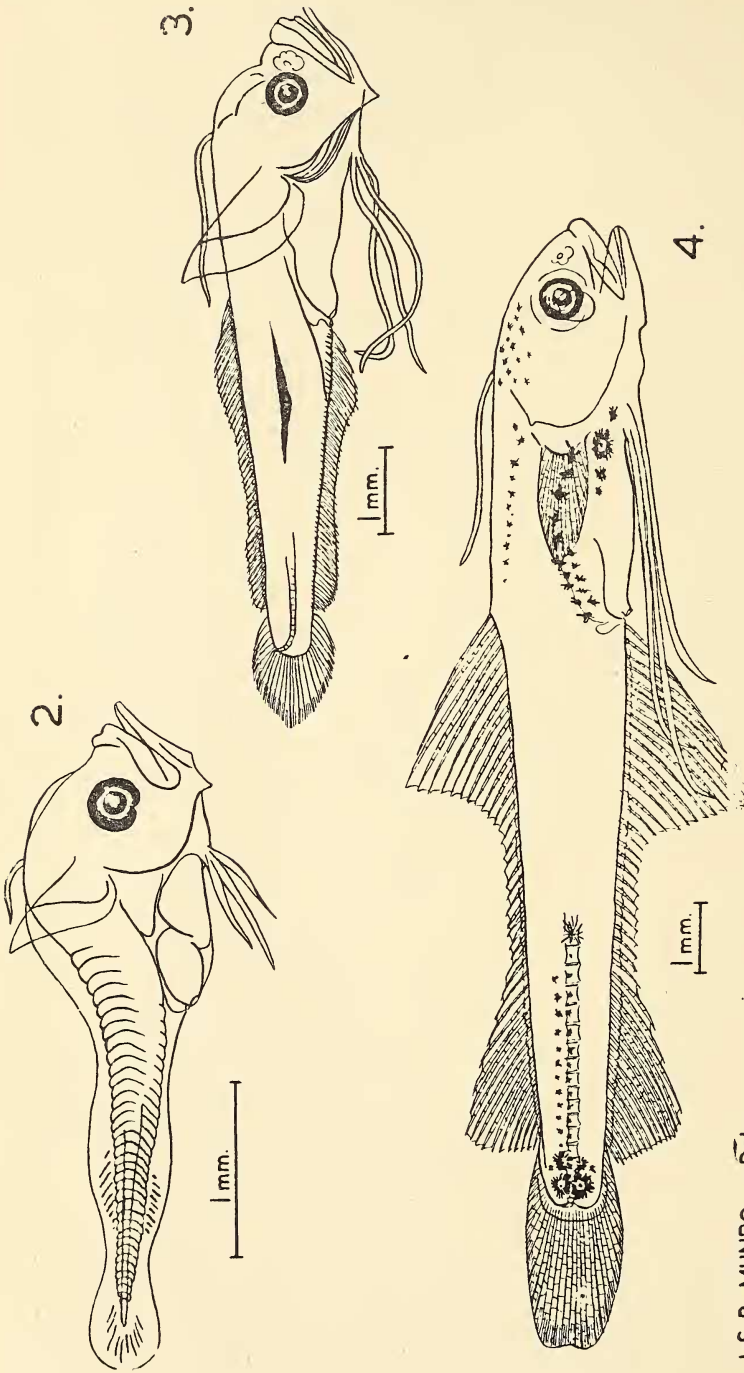
post-larval stages from plankton collections made by F.R.V. "Warreen" in the vicinities of Lady Elliot Island, Break-Sea Spit, Cape Moreton, Cape Byron, Coff's Harbour, Trial Bay, Crescent Head, Crowdy Head, Port Stephens, Sydney Heads, Jervis Bay, and Bermagui.

Larval Stages.—The immature specimens from Wewak measure 16.5, 19.0 and 19.5 millimetres respectively. The sixty-four planktonic specimens obtained by F.R.V. "Warreen" vary in length from 2.1 to 21.7 millimetres.

No. of Specimens	Size Range	Station	Position	Date	Net	Depth
1	16.8 mm.	40A/38	26° 54' S. 153° 24' E.	20.9.38	N70	25 m.
12	8.4-21.7 mm.	"	" " " "	"	N200	0 m.
1	9.1 mm.	46/38	24° 20' S. 153° 02' E.	19.9.38	N70	25 m.
7	4.2-9.8 mm.	"	" " " "	"	N200	0 m.
1	14.0 mm.	48/38	27° 02' S. 153° 45' E.	21.9.38	N100	0 m.
2	14.7-16.8 mm.	49/38	28° 37' S. 153° 42' E.	21.9.38	N200	0 m.
1	11.9 mm.	52/38	30° 16' S. 153° 32' E.	23.9.38	N100	0 m.
1	9.1 mm.	128/39	32° 37' S. 152° 22' E.	3.5.39	N100	25 m.
4	4.2-6.3 mm.	133/39	28° 38' S. 153° 43' E.	6.5.39	N70	25 m.
2	8.0-10.8 mm.	"	" " " "	"	N100	25 m.
3	15.4-16.1 mm.	136/39	27° 03' S. 153° 31' E.	14.5.39	N70	25 m.
1	16.8 mm.	"	" " " "	"	N100	0 m.
7	14.7-16.8 mm.	"	" " " "	"	N100	25 m.
1	11.9 mm.	137/39	30° 55' S. 153° 08' E.	16.5.39	N70	25 m.
1	14.0 mm.	"	" " " "	"	N100	25 m.
3	16.1-19.6 mm.	139/39	31° 51' S. 152° 50' E.	17.5.39	N70	25 m.
9	14.0-18.9 mm.	"	" " " "	"	N100	25 m.
1	8.4 mm.	196/39	24° 15' S. 153° 03' E.	7.7.39	N200	0 m.
2	2.1-4.2 mm.	203/39	Off Crescent Head ...	18.7.39	N100	9-200 m.
1	3.9 mm.	31/40	24 miles SE. of Sydney Heads	25.4.40	N70	0-200 m.
1	7.0 mm.	33/40	15 miles ENE. of Jervis Bay ...	30.4.40	N70	0-200 m.
1	4.9 mm.	"	" " " "	"	N100	0-200 m.
1	11.2 mm.	73/41	12 miles ENE. of Bermagui ...	12.10.41	N100	0-50 m.

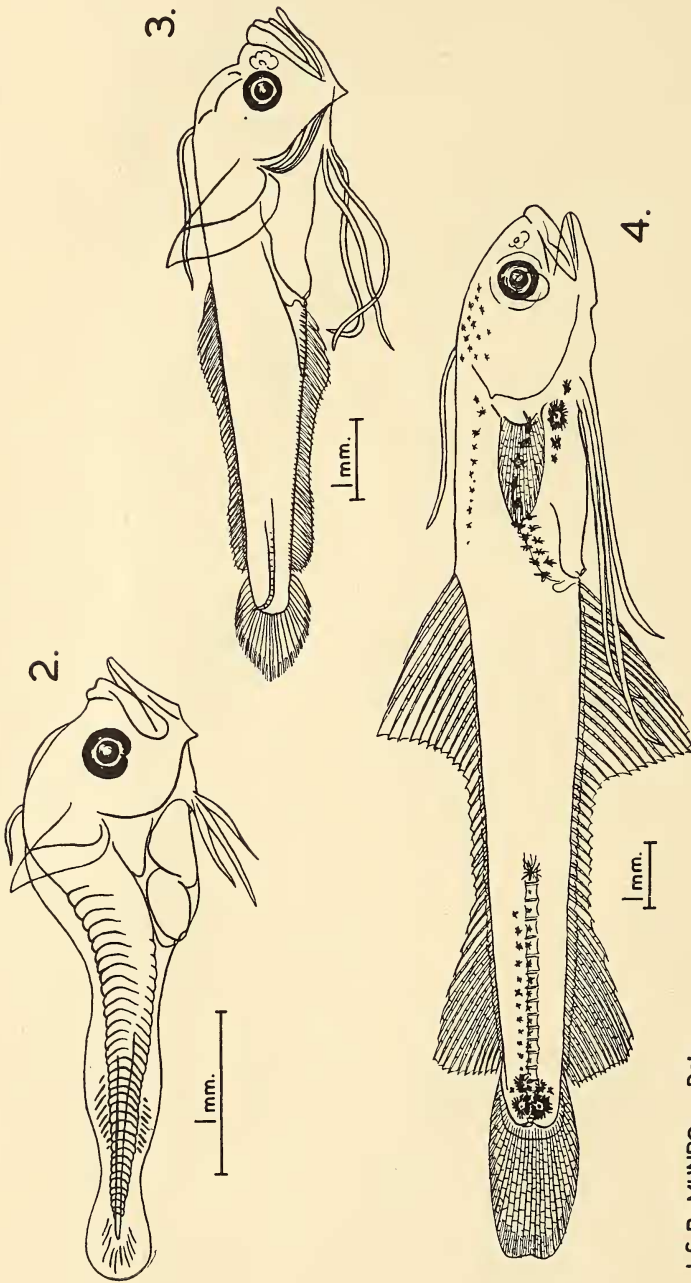
3.9 millimetre post-larva.—(Fig. 2). Yolk completely absorbed. Mouth and intestinal tract functional. Body short relative to depth. Head and visceral cavity disproportionately large. Eye black; choroid fissure incompletely closed. Maxilla extends to below middle of pupil. 39 or 40 myomeres. Fins little differentiated. Nuchal appendage present. Ventral fins represented by rudiments divided into 3 unequal rami. Pectoral present, consisting of an undivided fold and a muscular base. Dorsal, anal and caudal fins represented by a continuous fin fold in which rays of each fin are incompletely differentiated. Pigment entirely lacking.

8.0 millimetre post-larva.—(Fig. 3). Considerable increase in development of body form and differentiation of fins. Body more elongate than in 3.9 millimetre larvae. Head 4.5, depth 5.0 in body length without caudal. Eye has lost choroid fissure; 3.5 in head, slightly less than snout. Maxilla extends to below pupil. Branchiostegal rays plainly visible. Pectoral fin 0.75 of head length. Nuchal appendage



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TEXT FIGS. 2-4.—Fig. 2: *Bregmaceros nectabanus* Whitley, 3.9 millimetre postlarva from "Warreen" station 31/40 (off Port Hacking). Fig. 3: *Bregmaceros nectabanus* Whitley, 8.0 millimetre postlarva from "Warreen" station 133/39 (off Cape Byron). Fig. 4: *Bregmaceros nectabanus* Whitley, 16.1 millimetre postlarva from "Warreen" station 136/39 (off Cape Moreton).



I. S. R. MUNRO Del.

TEXT FIGS. 2-4.—Fig. 2: *Bregmaceros nectabanus* Whitley, 3.9 millimetre postlarva from "Warreen" station 31/40 (off Port Hacking). Fig. 3: *Bregmaceros nectabanus* Whitley, 8.0 millimetre postlarva from "Warreen" station 133/39 (off Cape Byron). Fig. 4: *Bregmaceros nectabanus* Whitley, 16.1 millimetre postlarva from "Warreen" station 136/39 (off Cape Moreton).

extends to origin of dorsal fin ; slightly exceeds head length. Ventral fin rays (3) extend to the end of anterior part of anal fin ; reach 0.4 of the body length without caudal. Rays completely differentiated in all fins. Dorsal and anal separated from caudal. Caudal rounded or slightly pointed. In specimen figured D. 43, A. 45, C. 26. Anal and dorsal fins not differentiated into high and low parts. Eye black. Body otherwise unpigmented. First appearance of chromatophores is at 9.0 millimetres, when a few large stellate melanophores develop on the caudal base.

16.1 millimetre *post-larva*.—(Fig. 4). Typical of series which range from 14.0 to 21.7 millimetres. Most of adult facies present. Head 4.8, depth 7.0 in body length without caudal. Eye small, 4.5 in head, less than snout or interorbital ; equipped with an adipose lid and pigmented black. Maxilla extends to below posterior border of pupil. Nuchal appendage equal to head length, does not quite reach to origin of dorsal fin. Ventrals reach anterior tip of anal but less than 0.5 of body length without caudal. Anal and dorsal fins with elevated anterior and posterior sections as in adults. In specimen figured, D. 14 + 11 + 17, (42), A. 17 + 12 + 18, (47). In the Wewak specimens D. 18 + 12 + 17, (47) ; 14 + 10 + 18, (42) ; 14 + 10 + 19, (43) and A. 18 + 9 + 21, (48) ; 16 + 10 + 18, (44) ; 16 + 10 + 17, (43). Caudal now slightly emarginate. Pectorals 0.6 of head length, with 15 or 16 rays. Scales present but difficult to count ; one example has 17 transverse and 70 lateral series. Body white or pinkish in preserved condition, probably transparent in life. Several series of stellate melanophores present. A patch of small melanophores on postero-dorsal aspect of head. An oblique row of single series extends from angle of operculum to origin of dorsal fin. A few large melanophores between bases of pectoral and ventral fins. An internal cluster lines the upper surface of the visceral cavity. Four to six large, stellate chromatophores on caudal peduncle. A single series continues forward above the lateral mid-line to the origin of the posterior elevated portion of the dorsal fin. Some internal melanophores invest the vertebral column in the caudal region. All fins hyaline.

BREGMACEROS MACCLELLANDI Thompson.

Bregmaceros macclellandi Thompson (*ex* Cantor's MS) 1840, p. 184, fig. 6 (Ganges Delta). Günther 1862, p. 368 (China Sea ; Philippine Islands). Day 1865, p. 171 (Malabar and Bengal Coasts). Day 1875-1878, p. 418 (India). Day 1889, p. 433, fig. 151 (Bombay Coast, Burma, Andaman Islands). Günther 1889, pp. 22-25, pl. 3, figs. A, B (Indian Ocean, Pacific Ocean, Amboina, Indian Archipelago). Alcock 1893, p. 181 (Bay of Bengal). Alcock 1899, p. 75 (Bay of Bengal, Andaman Islands, Malabar Coast). Weber 1913, p. 174 (Madura Sea, Bima Bight, Molo Straits, Borneo Bank, N. Celebes (Kwandang Bay), Molucca Passage, Halmahera Sea, Waigeu, W. Ceram (Kawa Bay), Sula-Besi (Sanana Bay), Banda Sea, Wowomi-Buton, Buton Straits, S. Celebes-Saleyey, Ambon, Kei Islands, Savu Sea, N. Soembawa (Salah Bight), Flores Sea). Gilchrist and Thompson 1914, p. 87 (Cape Natal). Gilchrist and Thompson 1917, p. 320. Barnard 1925, p. 325 (Agulhas Bank ; Natal). Weber and Beaufort 1929, p. 6, fig. 2 (N. Java, Samarang Road). Smith 1933, p. 53 (Siam). Delsman and Hardenberg 1934, p. 32, fig. 23.

Colloptilum mirum Richardson 1843, p. 95, pl. 46, figs. 4-7 (China Seas).
Asthenurus atripinnis Tickell 1865, p. 32, pl. 1 (Bay of Bengal off Akyab).
Bregmaceros atripinnis Day 1869, p. 522. Day 1875-1878, p. 418, pl. 91, fig. 1.

Bregmaceros sp. Wood-Mason and Alcock 1891, p. 29 (Bay of Bengal, off mouth of Kistna River).

D. (15-20) + (10-17) + (13-22), (41-57). A. (18-22) + (10-16) + (15-26), (43-63). Lat. sc. 54-71. Trans. sc. 13-16. Depth 5.5 to 7.0, head 5.5 to 7.0 in body length without caudal. Eye moderate, 3.5 to 4.5 in head, equal to or slightly less than interorbital and snout. Maxilla extends to below middle of eye, 2.1 to 2.5 in head. Nuchal appendage 0.4 to 0.5 longer than head. Dorsal fin inserted slightly in advance of anal fin. Longest anal rays 0.25 greater than head. Ventrals 0.63 of body length without caudal, extending past end of first section of anal fin. Pectorals equal to head without snout. Nape and back brown. Cheeks and flanks silvery or greenish, minutely dotted with small brown chromatophores. Dorsal, pectoral, anal and caudal fins blackish. Ventrals whitish. In young, fins hyaline with peripheral portions blackish. Pharyngial and abdominal epithelia black. (Compiled).

The Australian Museum has a single example (Reg. No. B 7536) from Bombay, 79 millimetres total length, procured from Dr. Francis Day in 1885 as *B. atripinnis*. D. 20 + 19 + 23, (62). A. 20 + 16 + 25, (61). Lat. sc. 76. Trans. sc. 14. Head 6.5, depth 6.5 in body length without caudal. Eye 3.0 in head, equal to interorbital, 1.4 in snout. Maxilla extends to below posterior edge of pupil, 2.0 in head. Nuchal appendage twice head. Dorsal fin inserted slightly in advance of anal fin. Longest anal rays 0.25 greater than head. Ventrals 0.5 of body length without caudal. Pectorals 0.9 of head length. Colour brownish; skin minutely dotted with brown specks, about 3 to 5 under each scale. Pectoral and caudal fin dusky. Dorsal dark distally. Ventrals and anal white. Pharyngial epithelium black.

Distributed throughout the Indo-Pacific, including eastern Africa, India, Burma, Andaman Islands, China, Philippine Islands and Netherlands East Indies. Former records from Australia (Darwin and Cambridge Gulf) refer to *B. nectabanus*. Although adults are unknown from Australian seas, larvae have been obtained in plankton nets by F.R.V. "Warreen" from Queensland (Break-Sea Spit) and New South Wales (Coff's Harbour and Narooma).

Larval stages.—1 prolarva and 4 post-larvae are included in the plankton collections and they are identified as *B. macclellandi* on the basis of pigmentation and body proportions.

Specimens	Station	Position	Date	Net	Depth
11.2 mm. } 13.6 mm. }	52/38	30° 16' S. 153° 32' E.	23.9.38	N100	0 m.
12.6 mm	144/39	36° 15' S. 150° 24' E.	31.5.39	N200	100 m.
6.6 mm.	195/39	24° 21' S. 153° 22' E.	7.7.39	N100	0-200 m.
5.8 mm.	30/40	30° 18' S. 153° 32' E.	22.4.40	N100	0-200 m.

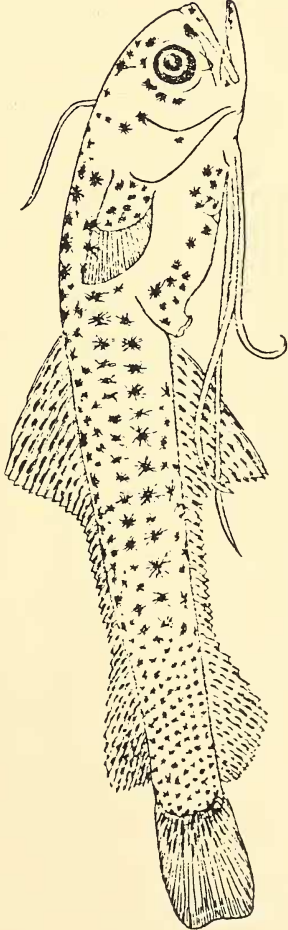
5.8 millimetre prolarva.—(Fig. 5). Yolk almost completely absorbed. Mouth large, functional. Intestine of several clearly defined coils. Eye black, choroid fissure not closed. Pectoral and ventral fin rudiments.



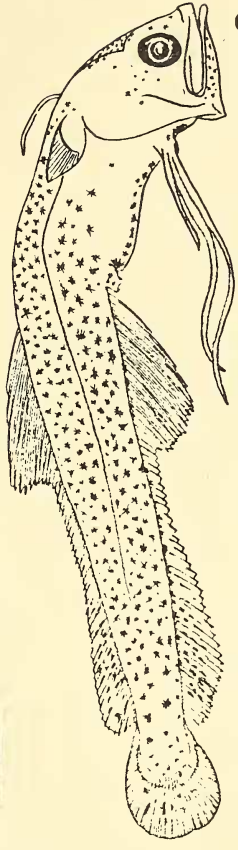
6.



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TEXT. FIGS. 5-8.—Fig. 5 : *Bregmaceros macclellandi* Thompson, 5.8 millimetre postlarva from "Warreen" station 30/40 (off Coff's Harbour).
 Fig. 6 : *Bregmaceros macclellandi* Thompson, 6.6 millimetre postlarva from "Warreen" station 195/39 (off Break-Sea Spit). Fig. 7 : *Bregmaceros macclellandi* Thompson, 13.6 millimetre postlarva from "Warreen" station 52/38 (off Coff's Harbour). Fig. 8 : *Bregmaceros japonicus* Tanaka, 11.5 millimetre postlarva from "Warreen" station 50/38 (off Cape Byron).

present. Unpaired fins represented by a continuous fin fold. No fin rays differentiated. Nuchal appendage either undeveloped or detached. Ventral fins represented by a single elongate process, not differentiated into rays. About 45 myomeres. Four dorsal and two ventral large, stellate melanophores at junction of myomeres and fin folds. Smaller melanophores on caudal part of fin fold, fleshy base of pectoral rudiments, intestinal loops and supracephalic sinus. General facies of this prolarva, especially the elongate ventral fin rudiment, indicate identity with the genus *Bregmaceros*. The large melanophores which are carried over into later stages, indicate this particular species.

6.6 millimetre post-larva.—(Fig. 6). Body short relative to depth. Head and visceral cavity disproportionately large. Eye lacking choroid fissure; black. Operculum and branchiostegals clearly differentiated. All radials of dorsal, caudal and anal clearly visible. D. 50. A. 52. C. 26. Caudal fin rounded. Both dorsal and anal fins elevated anteriorly and posteriorly. Nuchal appendage present but probably broken. Ventrals divided into 3 unequal rays. A reticulum of small, stellate melanophores invests the dorsal aspect of visceral cavity. A few are scattered over cheeks and base of pectoral fin. Four dorsal and four ventral giant, stellate melanophores on trunk. They are internal to the musculature and probably represent those on the fin folds of 5.8 millimetre larvae.

11.2 to 13.6 millimetre post-larvae.—(Fig. 7). Advanced larvae measuring respectively 11.2, 12.6 and 13.6 millimetres, agree closely in all characters and appear to be later stages of the 5.8 and 6.6 millimetre larvae described above. Body form more closely approaches that of adult *B. macclellandi*. Head 4.5, depth 5.75 in body length without caudal. Eye 4.0 in head, equal to snout, slightly less than interorbital. Maxilla extends to slightly behind centre of eye. D. 47-48. A. 10 + 22 + 17, (49). C. 30, slightly emarginate. Ventrals 0.5 of body length without caudal. Pectorals 0.6 of head length; with 15 rays. Scales developed in largest specimen; 14 transverse series; lateral series indeterminate. Body pigmented with numerous small, stellate melanophores as noted by previous authors in the young of *B. macclellandi*. They are larger and arranged differently from those of *B. japonicus* larvae. In the region of the anterior parts of dorsal and anal fins are 5 or 6 longitudinal rows. Under the posterior part of the dorsal fin and on caudal peduncle are 7 or 9 such rows. Others are present on nape, cheeks, lips, breast, belly and fleshy base of pectoral. Unpaired fins heavily pigmented, especially the posterior parts of dorsal and anal and caudal base. Fin pigmentation consists of series of elongate melanophores distributed along the fin rays. They are packed closely together and partly cover membranes of posterior parts of dorsal and anal fins. Larvae of this species are shorter and greater in cross-section than larval *B. japonicus* of similar size and development.

BREGMACEROS JAPONICUS Tanaka.

Bregmaceros atlanticus japonicus Tanaka 1908, p. 42, fig. — (Sagami Sea, Japan—Type locality). Parr 1931, p. 49.

Bregmaceros japonicus Tanaka 1913, p. 190, pl. 51, fig. 197 (Sagami Sea, Toyama Bay, Kagoshima). Jordan, Tanaka and Snyder 1913, p. 406. Tanaka 1933, p. 332 and fig. —. Okada 1938, p. 270.

D. (15-17) + 20 + (20-23), (55-60). A. (23-32) + (2-6) + (23-24), (52-58). Lat. sc. 72-75. Trans. sc. 13-14. Depth 8.5 to 8.6, head 6.8 to 6.9 in body length without caudal. Eye 3.3 to 5.0 in head, less than interorbital and snout. Maxilla extends to posterior border of pupil, 2.3 in head. Nuchal appendage 0.6 longer than head. Dorsal fin inserted directly above anal fin. Longest anal ray 0.5 longer than head. Ventrals 0.6 of body length without caudal, extending almost to end of low part of anal fin. Pectorals equal to distance from centre of pupil to posterior end of head. Body dusky; back very dark. Dorsal, caudal and pectoral fins dark. Ventral and anal fins dusky. Inner lining of operculum black. (Compiled).

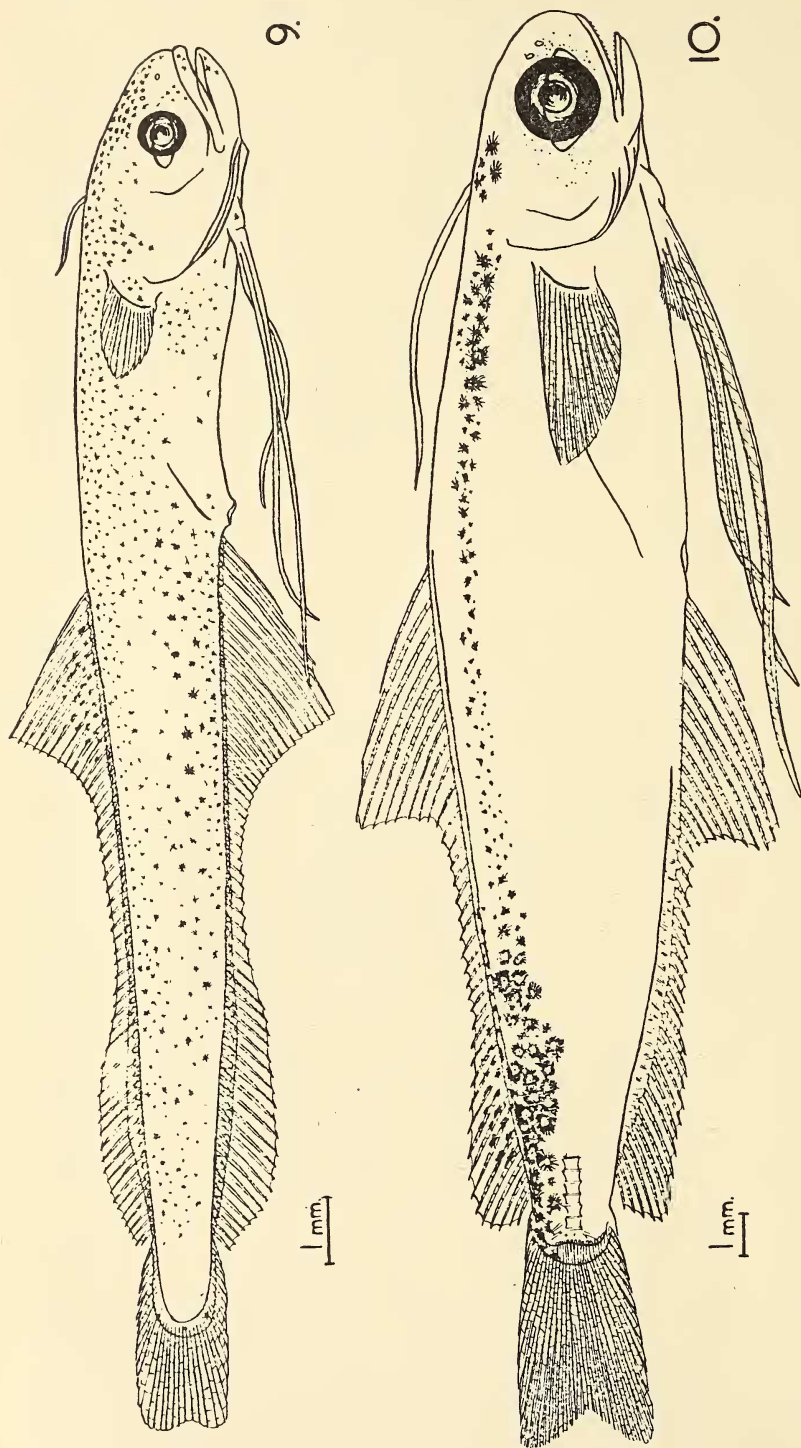
Hitherto known only from Japan. Although adults are unknown from Australian seas, planktonic larvae have been obtained by F.R.V. "Warreen" from off the coast of New South Wales (Coff's Harbour, Crescent Head and Port Hacking). The species is known also from northern New Guinea on the basis of a 25.0 millimetre specimen from Madang Harbour, collected by M.V. "Fairwind" (26.10.49) using a submarine lamp. Considered by some to be a form of *B. atlanticus*.

Larval stages.—There are 3 post-larvae which differ from those of *B. maccllellandi* in pigmentation and proportions. Their elongate bodies and more numerous fin rays identify them as *B. japonicus*.

Specimens	Station	Position	Date	Net	Depth
11.5 mm.	50/38	28° 37' S. 153° 54' E.	22.9.38	N200	0 m.
21.0 mm.	104/38	34° 3' 30" S. 151° 39' E.	15.12.38	N200	0 m.
22.4 mm.	203/39	Off Crescent Head	18.7.39	N100	0-200 m.

11.5 millimetre post-larva.—(Fig. 8). Development is slightly less advanced than in the largest post-larva of *B. maccllellandi*, from which it differs in having a more elongate body, greater numbers of dorsal and anal fin rays, and a pigmentation of smaller and more numerous melanophores. Head 5.5, depth 7.5 in body length without caudal. Eye equal to snout, 4.0 in head. Dorsal fin inserted slightly behind anal. Caudal fin rounded, whereas larval *B. maccllellandi* of equal length has emarginate fin as in adult. Ventrals less than 3.0 in body length without caudal. D. 52-53. A. 17 + 12 + 28, (57). Numerous small stellate melanophores are scattered over the entire body and comprise 8 to 10 irregular horizontal rows. Visceral region is unpigmented except for a mid-ventral series of melanophores between the breast and anus. Others are present on supraceutical sinus, snout, preoperculum and mandible. Unpaired fins hyaline except for a few small melanophores on the basal parts of the posterior rays of dorsal and anal, and a few scattered on the caudal rays.

21.0 to 22.4 millimetre post-larvae.—(Fig. 9). Form and proportions are similar to adults of *B. japonicus*. Head 5.6, depth 7.0 to 9.0 in body length without caudal. Eye 1.0 to 1.5 in snout and interorbital, 5.0 in head, black and equipped with an adipose lid. D. 14 + 16 + 23, (53). A. 20 + 11 + 25, (56). Dorsal fin inserted noticeably behind anal origin. Ventrals extend 0.36 to 0.5 of the body length without the caudal. Pectorals 2.5 in head, with 16 to 17 rays. Maxilla reaches almost to hind border of eye. Nuchal appendage short but may be broken. Body pigmented with numerous, small, stellate melanophores



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TEXT FIGS. 9 AND 10.—Fig. 9: *Bregmaceros japonicus* Tanaka, 21.0 millimetre postlarva from "Warreen" station 104/38 (off Sydney Harbour). Fig. 10: *Bregmaceros varisquamosus* sp. nov., 33.3 millimetre female from Bostrem Bay, Sek Harbour, North Coast of New Guinea. Scale tracts not shown.

scattered irregularly over most of head and trunk. Cheeks and posterior part of visceral region unpigmented. Interorbital region with a prominent cluster of melanophores. A few small melanophores present on lips and fleshy bases of pectoral and ventral fins. Dorsal, anal and caudal fins hyaline, distinct from the heavily pigmented unpaired fins of *B. macclellandi*. At most, a few melanophores on the basal parts of the anterior dorsal rays. The 25.0 mm. post-larva from Madang has D. 17 + 20 + 22, (59) and A. 22 + 12 + 25, (59). There are 75 lateral and 14 transverse scale rows and the pigmentation is similar to that of Australian specimens.

BREGMACEROS BATHYMASTER Jordan and Bollman.

Bregmaceros bathymaster Jordan and Bollman 1889, p. 173 (Gulf of Panama—Type locality).

Bregmaceros longipes Garman 1899, p. 191, pl. 43, figs. 6-9 (Mexico, Pacific coast near Acapulco). Parr 1931, p. 49.

Bregmaceros macclellandi (non Thompson) Jordan and Evermann 1896-1900, p. 2526.

D. 18 + 10 + 19, (44-47). A. 19 + 10 + 19, (44-48). Lat. sc. 60-62. Trans. sc. 10. Depth 6.6 to 7.0, head 5.0 to 5.6 in body length without caudal. Eye large, 3.0 in head, greater than interorbital and approximately twice snout. Maxilla extends to or beyond middle of eye, 2.2 in head. Nuchal appendage 0.3 longer than head. Dorsal fin inserted slightly in advance of anal fin; longest ray 0.75 of head length. Ventrals 0.66 of body length without caudal, extending to end of first section of anal fin. Pectorals shorter than head. Nape and back brown. Several rows of dark dots along front part of back and near base of anal fin. Flanks, cheeks and iris silvery. Dorsal fin dusky. Caudal fin pale, dusky at base with narrow white cross bar. Other fins pale. (Compiled). Restricted to the Pacific coast of Central America.

BREGMACEROS ATLANTICUS Goode and Bean.

Bregmaceros atlanticus Goode and Bean 1886, p. 165 (West Indies, off Grenada and Nevis—Type locality; Gulf of Mexico). Goode and Bean 1895, p. 389, pl. 95. Jordan and Evermann 1896-1900, p. 2527. Borodin 1928, p. 13 (Caribbean Sea, off Rancador Reefs). Parr 1931, p. 49. Parr 1937, p. 62 (West Indies, off Cuba and Bahamas).

Bregmaceros macclellandi (non Thompson) ? Norman 1930, p. 339 (Western Africa off Cape Lopez and Sierra Leone). ? Norman 1935, p. 9 (Angola, off St. Paul de Loanda). ? Fowler 1936, pp. 1254, 1355.

D. (15-16) + x + 16, (48). A. (15-16) + (7-8) + (21-22), (43-50) or 20 + 9 + 37, (64). Lat. sc. 65. Trans. sc. 10. Depth 7.6 to 8.0, head 5.0 to 5.75 in body length without caudal. Eye moderate, 3.5 to 4.0 in head, 1.3 to 1.5 in interorbital, equal to or slightly less than snout. Maxilla extends to below posterior edge of eye, 2.0 in head. Dorsal fin inserted directly above anal fin; longest ray 0.2 greater than head. Ventrals 0.6 of body length without caudal, extending to end of first section of anal fin. Pectorals shorter than head. Nuchal appendage 0.5 greater than head, but according to Borodin (1928) twice body length in young. Body uniformly dusky. Young with many small, dusky stellate melanophores scattered over body. (Compiled).

An Atlantic Ocean species from Western Indies, Caribbean Sea and probably the west coast of Africa.